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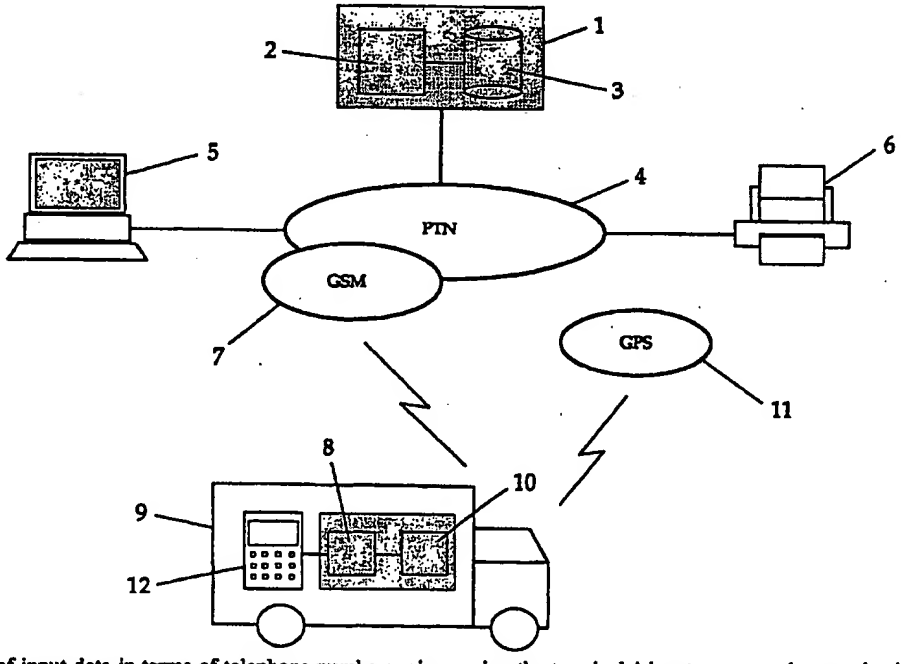
(54) Title: INFORMATION SYSTEM FOR CONTROLLING OF VEHICLES

(57) Abstract

An information system comprising a common centre (1) for storing data in terms of map information and for processing and generating data in the form of navigating instructions for a vehicle (9) and which comprises a register (3) of telephone numbers with correlated addresses and geographical coordinates by which origins and destinations are determined on basis of telephone numbers. Said information system further comprises terminals (5, 6, 12) communicating with the common centre (1) which in vehicles (9) comprise a radio communication device with means for presentation and in which vehicles (9) a device (10) is also present for determining the vehicles' positions in terms of geographical coordinates, and a device (8) in which input data from input means belonging to the terminal (12) are added together with the vehicle position data. On the basis of input data in terms of telephone numbers, given using the terminals' input means and transmitted to the common centre (1) together with the vehicle position data, current positions in terms of addresses and geographical coordinates correlated to said telephone numbers can be determined and together with the transmitted vehicle position data be used as destination and origins when the common centre (1) generates navigational instructions for the vehicles (9). Said navigational instructions are transmitted back to the terminals (12) placed in the vehicles where they are temporarily stored in the device (8) for adding together input data in order to be presented by the means for presentation dependent on the vehicle position.



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Information system for controlling of vehicles

TECHNICAL FIELD

The present invention relates to an information system for vehicle navigation according to the preamble of claim 1.

BACKGROUND OF THE INVENTION:

Road transport informatics is an area of growing importance in pace with the growing share of transportation in production systems for products and services. Fundamental for this development are communication possibilities with the vehicles, which nowadays can be handled via a cellular mobile radio network, such as GSM (Global System for Mobile Communication) and Mobitex, and be complemented in the future with infrared or microwave links for short distances. Possibilities for vehicle navigation and vehicle tracking are other needs which now also must be covered within this chain of development.

The vehicle navigation and tracking systems now being developed are normally based on positioning equipment for dead reckoning and an electronic compass or GPS receiver within the vehicles. The navigation itself uses a map-information database which is stored in the vehicle computer and/or in a central computer with which the vehicles can communicate. The map-information database contains i.a. all roads and streets as vectors and the street names, together with speed limits and the like as attributes. By the user giving his desired destination, the shortest or fastest route to the destination may be calculated from the user's present position. The navigation

will then be assisted by some graphical support on a display in the vehicle. If the vehicle also communicates with a central computer which is continuously updated about the present traffic situation, then the navigation could be dynamic, with the route selection continuously affected by the traffic picture. By means of the vehicle communicating its position to a central computer, the information can be further transmitted to a management centre for the vehicle fleet.

Several systems for navigational assistance are known. For instance, International Patent Application WO 92/10808 describes a route planning system in which route data is transmitted from a "centre" to a in-vehicle computer for generating navigating instructions.

Another example of a known system for navigational assistance is described in European Patent Application EP 0 345 818. This system comprises a central computer for route planning and a large number of short distance communication links to the vehicles.

Common to all the known systems is that they do not employ standardised equipment. Instead, each system requires its own specific fixed equipment and special vehicle terminals, with varying degrees of cumbersome input of destination data. In-vehicle route planning systems based upon map-information databases also suffer from a lack of digital maps and a need for individual updating. These systems cannot normally be used for vehicle tracking.

Consequently there is a need for a general information system for vehicle navigation by which cost effective, up-to-date, navigational assistance can be offered and in which the users can easily specify destinations and by

which vehicles can be tracked. The system equipment needed by the users should also be easy to install and to use.

SUMMARY OF THE INVENTION:

The above-mentioned object is achieved by an information system according to the present invention, the characteristics of which are detailed in claim 1.

The information system is based on a common centre for processing data for vehicle navigation and can, just like the system described in American Patent US 4,954,958, translate telephone numbers belonging to fixed telephone installations into positions in terms of addresses and geographical coordinates. In addition, the system incorporates the unique feature that even telephone numbers belonging to mobile telephones placed in vehicles comprised by the system can be translated into the vehicles' current geographical positions. Positions and destinations can thus be given in terms of telephone numbers, and input data to the information system can be fed through simple numerical keyboards on for instance faxes and mobile telephones. This opens up completely new opportunities for ordering and presenting a whole set of new services from such terminals.

BRIEF DESCRIPTION OF THE DRAWINGS:

Fig. 1 illustrates a schematic representation of an information system according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The invention shall be described in the following with reference to FIG.1.

The information system comprises a common centre 1 containing a processor 2 with routines/software for route planning, and a database 3 which i.a. comprises map information and telephone number/address registers. The

common centre is connected to the public telephone network (PTN) 4. The common centre is connected via the public telephone network to different terminals, such as computer terminals 5, faxes 6 and, via a mobile telephone system 7, terminals 12 in vehicles 9. The vehicles also contain equipment 10 by means of which information from a positioning system 11 can be used. The term "terminal" mentioned above will be used as a common label for different means for communicating with the common centre and can, as pointed out above, be represented by computer terminals, faxes, telephones, mobile telephones, etc.

The common centre 1 represents an important part of the information system. Via the telephone network, its database 3 can be updated continuously with regard to traffic conditions, road works, transfer of telephone numbers etc., whereby up-to-date information can always be used for the route planning.

In the common centre 1, a tele-number can be translated by the help of the database 3 into the subscriber's address which in turn can be translated into geographical coordinates. The term "tele-number" here means a telephone number, a number to computer terminals and faxes, a number to mobile telephones, etc. Input data to the information system regarding positions and destinations can thereby be any tele-number for a certain subscriber, the subscriber's address or corresponding geographical coordinates. For tele-numbers concerning mobile units, however, the subscriber's address cannot be used for positioning for obvious reasons.

From a fax 6 which is connected to the common centre 1 via the public telephone network 4 and whose position is defined by its tele-number, a trip plan or a route plan comprising one or more destinations given in terms of

tele-numbers can be ordered and received. The trip plan or route plan is then received on paper which can be taken along during the transportation.

In a similar way, a trip plan or route plan can be ordered from a stationary computer terminal 5, which plan is based on destination information in terms of tele-numbers which have been given to the common centre 1 by the computer terminal. The result of the work performed in the common centre is transmitted to the computer terminal where it is presented on the computer display or stored temporarily for later use. For instance, such services could be ordered from an automatic petrol pump at which the result is written on the receipt slip.

Destinations can be given as tele-numbers both from and to a terminal 12 in a vehicle 9. The terminal could in this case be a mobile telephone or a computer terminal which for instance is included in the Mobitex system. Since the database in the common centre does not always contain the present position of the mobile terminal, this is given directly in terms of geographical coordinates when the vehicle connects itself to the centre or vice versa. These coordinates can for instance be received from a GPS-receiver 10 (Global Positioning System) in the vehicle, or from some other positioning system.

A new type of standardised equipment to be used for future services within road transport informatics is placed in the vehicle 9. This equipment, called "vehicle unit 8" in the following, is made up of a microcomputer with memory to which the GPS receiver 19 with antenna is connected. The vehicle unit is further connected to a GSM-telephone and equipped with a computer interface, an alarm input and a power supply connection. The GPS-receiver and the vehicle unit could of course be integrated in one unit.

The software for the vehicle unit 8 is designed in such a way that in the vehicle the GSM telephone keyboard, display and sound unit can be used for the input, display and reproduction of data, and its radio unit for data communication with the common centre 1 via the mobile telephone system and the public telephone network 4. The software can further automatically store away ongoing route guidance activities in case of normal use of the GSM-telephone, and restore these when the phone call is terminated. Data input and output through the computer interface can also be communicated further via the GSM-telephone. During installation, the specific software for the information system can be transmitted to the vehicle unit from the common centre via the GSM-telephone.

The vehicle unit 8 does not need to be exposed or directly accessible in the driver compartment, but instead it can be installed wherever it is easiest to do so. Since established systems such as GSM are used, the vehicle equipment becomes relatively inexpensive and easy to install.

The computer terminal 5 can for instance be located at a company whose vehicles are to be guided to different destinations. Via modem, it is possible for the computer terminal to communicate with the vehicle terminal 12 for reporting to and from the vehicle. All manual inputs to the information system that can be done in the vehicle, can also be done directly via the computer terminal 5. The computer terminal can consequently communicate directly with the common centre, which simplifies the input if the trip comprise a large number of destinations.

The use of the information system for trip and route planning will now be described. The term trip plan here refers to a determination of a suitable visiting sequence

for a number of destinations from the vehicles origin. In addition, the distance and travel time between these respective destinations are calculated. Various software for trip planning is commercially available.

Via the terminal 12 (the GSM-telephone) in the vehicle 9, one or more destinations can be given in terms of tele-numbers which are then transmitted to the common centre together with the present GPS-coordinates for the vehicle via a pre-installed tele-number. The sequence for the destinations is optimised in the common centre, whereby the present position is also considered as a final destination if nothing else is given. The information is then transmitted back to the vehicle and presented in the form of registers via the GSM-telephone display, which could comprise two rows with twelve characters each. For two destinations, the activities could be as follows.

1) Row 1 shows the tele-number to the first destination and row 2 shows road distance and estimated travel time from the origin.
2) Row 1 shows the tele-number to the second destination and row 2 shows road distance and estimated travel time from the first destination.
3) Row 1 shows the tele-number to the third destination and row 2 shows road distance and estimated travel time from the second destination.

Route guidance (see below) can then be ordered from the recommended sequence.

If the number of destinations is large, then trip planning, as earlier mentioned, can be ordered from a fixed computer terminal 5 communicating with the common centre 1. In addition to the previously mentioned information, the full address and accumulated road distances and travel times are

also shown. The sequence can be later transmitted to the vehicle terminals via the public telephone network and GSM. The route guidance itself is then ordered from the vehicle as above.

Trip planning can also be received via a fax. Tele-numbers to preferred destinations and origin, if other than the fax, are then given via the fax keyboard and the common centre replies with a trip plan which is received on paper and can be brought along in the vehicle. The trip plan contains the same information as received via the fixed computer terminals.

The earlier mentioned route guidance refers to a detailed description of the route to one or more destinations from the vehicle origin. The route guidance is ordered from the common centre via a pre-installed tele-number and is transmitted to the vehicle 9 where it is stored in the vehicle unit 8 in order to be presented in a way that is controlled by the position from the GPS-receiver 10. There also exists the possibility to store information about the vehicle size, weight and goods, to be used for the route selection in the common centre.

The route guidance contains the names or numbers of all roads and streets on the trip, and the coordinates of all crossings where a turn is to be made, as well as the distance between these. If the distance is more than ten kilometres, then additional coordinates with this division are included. The coordinates shortly before all turns that are to be passed or rejected are also included. In addition, the destination address, the road distance thereto, and an estimate of the arrival time based on estimates at each turn or at each ten kilometres are also included.

To present the route guidance through the GSM-telephone display, its two rows with twelve characters can each be used as follows:

A) During the trip row 1 shows the present road or street designation (12 first characters). Row 2 shows present road distance to the destination and estimated arriving time.

B) Before a turn is to be made, row 1 shows the next road or street. Row 2 shows a number of flashing arrows to the right (>>>>>>) or left, one arrow for each 50 meters left to the crossing.

D) Within 100 meters from the destination, and if no turns remain, then rows 1 and 2 show the full road or street address.

E) If a wrong turn is made or if a turn is forgotten, then row 2 displays an error message and the buzzer sounds. Only when one is driving back to the crossing does the display go over to one of the earlier alternatives.

When the arrows start to flash, the buzzer also sounds for a short while. If the Hands-Free function is connected, then a synthetic voice may for instance say "Keep right" when the arrows start to flash, and "Turn-right" when only one arrow is left. How far from the crossing the arrows starts to flash depends on the vehicle speed. At 130 km/h the course of events can start with twelve arrows and at 30 km/h with two arrows.

A route plan can also be received via a fax. Tele-numbers to preferred destinations and origin, if other than the fax, are then given via the fax keyboard and the common centre will reply with a route plan which is received on paper and can be brought along in the vehicle. The route plan contains names or number of all roads and streets on

the trip, and the road distance and estimated travel time between all turns. In addition, the destination address, the total road distance and estimated travel time are also included.

The route guidance can also include information concerning all open gas stations and restaurants along the recommended highways. All road toll stations along these highways may also be included. Pre-warning can be given at a set distance, at which the buzzer sounds and the GSM-telephone display shows the following:

F) Row 1 shows GAS, FOOD or GAS & FOOD. Row 2 shows road distance to this destination and the road distance to the next subsequent gas station and/or restaurant.

G) Row 1 shows ROAD TOLL. Row 2 shows road distance to this destination and the present fee.

Future road toll stations will be of free-flowing type and, independent of charging system, these road tolls must be equipped with cameras for identifying the registration number of those vehicles that cannot be charged in the usual way. By having the road toll operator open a tele-number for charging, this could be done via the vehicle based on information from the common centre.

Each time the vehicle engine is stopped, the present date, time, GPS-coordinates and road distance from last stop are stored in the vehicle unit. In this manner, a log book is created. The driver may chose to store the information under different accounts (0-9) to distinguish, for example, between private driving and driving for different customers, etc. Whenever the driver so wishes, the stored information can be transmitted to the common centre via a pre-installed tele-number. The GPS-coordinates are translated in the common centre into the closest road or

street address and for each account a log-book is generated containing dates, times, addresses and driving distances. Outside cities, the address is given by the road name with distance and direction from, and name of, the nearest crossing road.

The common centre can acknowledge these transmissions by transmitting back to the vehicle and storing in the vehicle unit the GPS-coordinates for all regional or national road tolls. In this manner, the passage of such can also be registered and presented in the log book.

The log-books consisting of computer print-outs are then mailed directly to the GSM-subscriber and can be used for bookkeeping purposes. This requires that the vehicle registration number has been stored in the vehicle unit for representation in the log-book. For the account 0 only the total driving distance and number of road toll passages are presented, which is why this account can be used for private driving.

Vehicle tracking which is a part of the information system can be ordered via the common centre using a GSM-telephone or a fax, whereby the vehicle tele-number is given via the GSM-telephone or the fax keyboard. Using the vehicle tele-number, the common centre can, by contact with the vehicle or directly through its database, find the latest registered positions of the vehicle. From corresponding geographical coordinates, the centre can determine the direction of travel and present road or street names with distances and directions from, and names of, the nearest crossing roads or streets. Position and travel directions are then sent as a text message to the GSM-telephone (Short Message Service) or the fax. Vehicle tracking cannot take place when trip registration is set for private driving (account 0).

Modern vehicles are to a high degree equipped with airbags and corresponding collision sensors, whose electrical signal can also activate the vehicle unit 8 so that an alarm message is sent to the common centre 1 via a pre-installed tele-number. In this manner, information concerning the GPS coordinates of the vehicle can be obtained and, on the basis of the tele-number for the vehicle terminal, the GSM-subscriber can be identified. If the vehicle registration number, size, weight and goods, have been stored in the vehicle unit, then this information is also received. The information is put together and the GPS-coordinates are translated into a position and a travel direction, just as for the vehicle tracking above, then the nearest responsible emergency centre is notified. The possibility for data communication via GSM is limited to 9.6 kbps which, in practice, limits the amount of data to the vehicle terminals if long waiting times are to be avoided. In normal use, the absolute largest data amount from the common centre is transmitted for route guidance and a maximal estimate of this flow is given by the following:

* The route guidance comprises 1000 crossings or nodes.
* Each node is described by 4 sets of coordinates with 8 digits for longitude and latitude, i.e. 8 numbers with 8 digits (<30 bit), which is 240 bit coded.
* Each road or link between these 100 nodes is described by 12 characters (<100 bit) and 2 numbers with 4 digits (<15 bit) for distance and time, which is 130 bit coded.

Summarised, a total data amount of 370 kbit is obtained which is transmitted in less than 40 seconds at a speed of 9.6 kbps. Even if the communication protocol does not allow

more than 4.8 kbps, the transmission time is acceptable for this very extensive route guidance.

The transmission of the log-book to the common centre and especially the software installation in the vehicle unit can naturally mean a lot greater data amounts, but longer transmission times are also easy to accept in these cases.

The invention is not limited to the above mentioned embodiments, but can be varied within the scope of the appended claims.

Claims:

1. An information system comprising a common centre (1) for storing data in terms of map information and for processing and generating data in the form of navigational instructions for a vehicle (9), which centre comprises a register (3) of telephone numbers with correlated addresses and geographical coordinates by means of which origins and destinations are determined on the basis of telephone numbers, and terminals (5, 6, 12) communicating with the common centre (1), which terminals in vehicles (9) comprise a radio communication device via which communication is made with the common centre (1) and whose means for presentation are intended to present speech and text, and in which vehicles 9 there also exists a first device (10) for determining the vehicle's position in terms of geographical coordinates, characterised in that a second device (8) is present in the vehicles (9) in which input data from input means belonging to the terminal (12) is added together with the vehicle position data, and that on the basis of input data in terms of telephone numbers, given using the terminals input means and transmitted to the common centre (1) together with the vehicle position data, current positions in terms of addresses and geographical coordinates correlated to said telephone numbers can be determined and, together with the transmitted vehicle position data, can be used as destinations and origin when the common centre (1) generates navigational instructions for the vehicles (9), which navigational instructions are transmitted back to the terminals (12) placed in the vehicles where they are temporarily stored in the second device (8) in order to be presented by the means for presentation dependent on the vehicle position.

2. An information system according to claim 1, characterised in that the vehicles' (9) position together with the tele-number of the terminal (12) placed in the vehicle are stored in the common centre (1) during communication between the terminal and the common centre.

3. An information system according to claim 2, characterised in that when input data from an asking terminal consist of a tele-number referring to a terminal (12) in a vehicle (9), the common centre (1) translates this tele-number into the stored position for the vehicle, which position is transmitted back to the asking terminal.

4. An information system according to any of claims 1-3, characterised in that when input data consists of a first tele-number which is being transferred to a second tele-number, the common centre (1) determines the geographical coordinates corresponding to this second tele-number.

5. An information system according to claim 1, characterised in that the second device (8) stores the vehicle (9) position and point of time when the vehicle stops and that this stored information is transmitted to the common centre (1) for storage.

6. An information system according to claim 1, characterised in that the trigger signal for an airbag in the vehicle (9) is connected to the second device (8), whereby in case of triggering of the airbag the vehicle position and telephone number are transmitted to the common centre (1) for identification and further transferring to an emergency centre.

7. An information system according to any of claims 1-6, characterised in that the radio communication equipment is a part of a mobile telephone system.

8. An information system according to claim 1, characterised in that the mobile telephone system (7) is GSM (Global System for Mobile Communication).

9. An information system according to any of claims 1-8, characterised in that the first device (10) is a receiver for GPS (Global Positioning System).

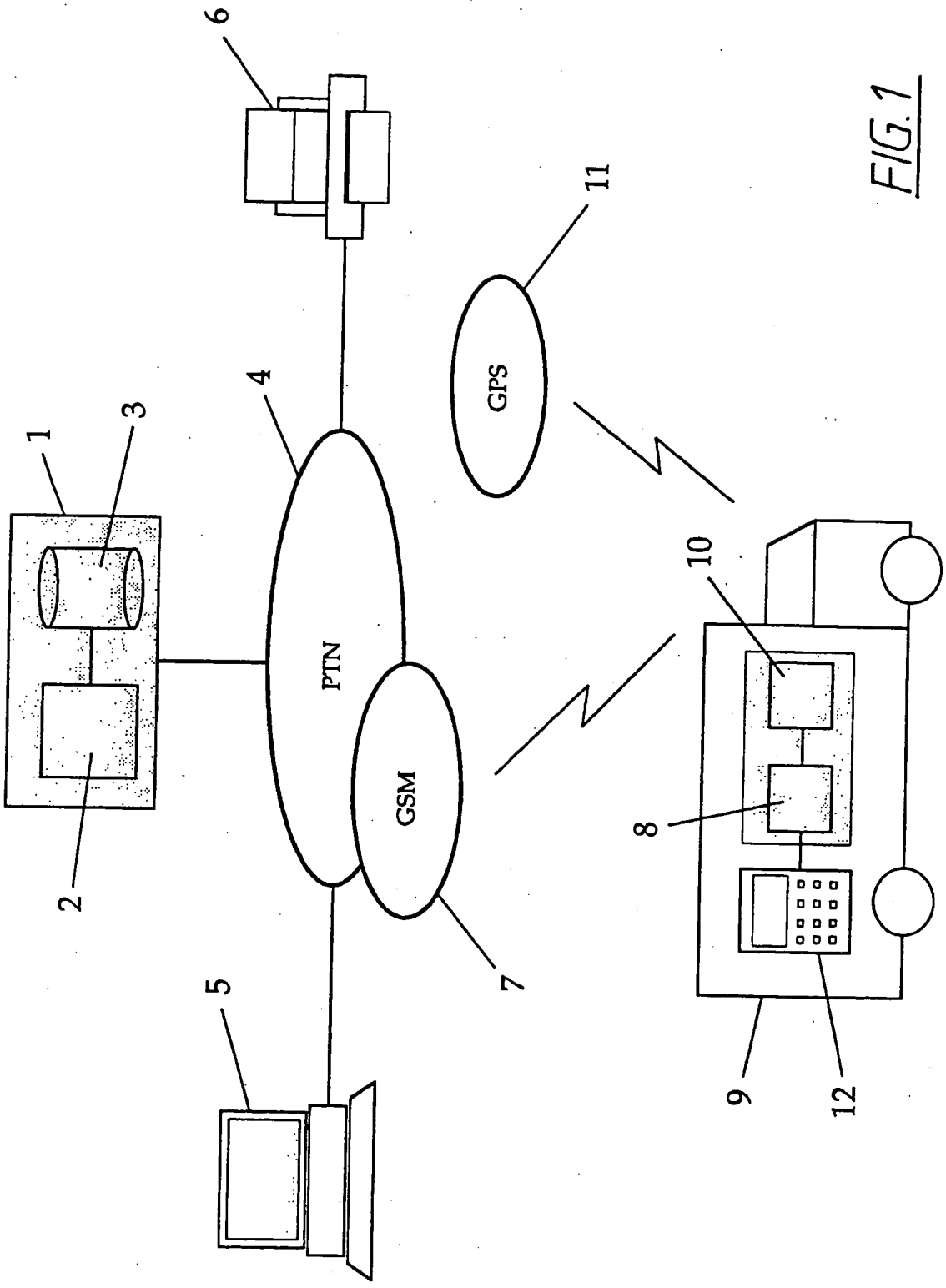

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/00091

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G08G 1/0968, G08G 1/133
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G01C, G06F, G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4954958 (CHARLES SAVAGE ET AL), 4 Sept 1990 (04.09.90), column 3, line 7 - column 5, line 27; column 11, line 33 - column 12, line 44, figures 11-13	1-9
A	WO, A1, 9214215 (PETERSON, THOMAS, D), 20 August 1992 (20.08.92), page 16, line 7 - page 18, line 34, figure 4	1-9
A	EP, A1, 0333330 (GEC-MARCONI LIMITED), 20 Sept 1989 (20.09.89), column 3, line 16 - line 37	1-9

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, A1, 4220963 (MITSUBISHI DENKI K.K.), 21 January 1993 (21.01.93), column 2, line 39 - line 57	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

03/05/95

International application No.
PCT/SE 95/00091

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		CA-A- 1326301	18/01/94
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